A. Poblaguev

1. ***VME based DAQ for the Hjet (status report).***
2. ***FADC based analysis of the Hjet signals.***

VME Based DAQ for the HJet

Current Status

- ***A Prototype is assembled in the Counting Room (Bldg. 1012)***
  - ✓ ***External Clocks (244 MHz) derived from the RF signals***
  - ✓ ***External Sync (Bunch Zero signals)***
  - ✓ ***External Trigger (derived from shaper spy signals)***
  - ✓ ***V124 Module is employed to monitor Jet Target State***
  - ✓ ***Wiener VME 64x crate is ordered (will be shipped by end of December)***
- ***Alpha-source signals in new detectors are intensively tested***

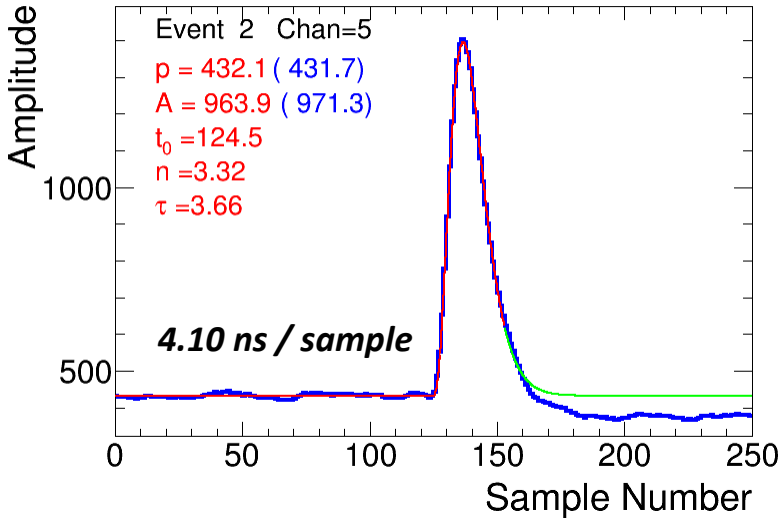
Know DAQ Related Issues

- ***We still have no FADC firmware with self trigger option.***
- ***One output connector in the signal distribution card is broken.***
- ***FADC module synchronization needs improvement.***
- ***One FADC channel (in a spare module) sometimes does not work.***

To be done

- ***Get new FADC firmware from JLab (self trigger)***
- ***Adopt old DAQ /Analysis code***
  - ✓ ***VME instead of CAMAC***
  - ✓ ***New data format (for waveforms)***
  - ✓ ***Interface to a new data format for online analysis.***
  - ✓ ***New Detector layout.***

A typical waveform: 3.183 keV α (^{148}Gd)



measured waveform
fit function W(t)
continuation of the fit function

Parameterization:
p - pedestal
A - amplitude
t_0 - signal time
n - shaper power
τ - shaper time

$$\mathrm{RMS}_{\mathrm{noise}} \approx 8.5$$

Signal parametrization:

$$A(t) \sim (t-t_0)^n \, exp\left(-\frac{t-t_0}{\tau}\right)$$

Waveform parametrization:

$$W(t) = p + Af(\xi, n), \quad \xi = \frac{t-t_0}{n\tau}$$

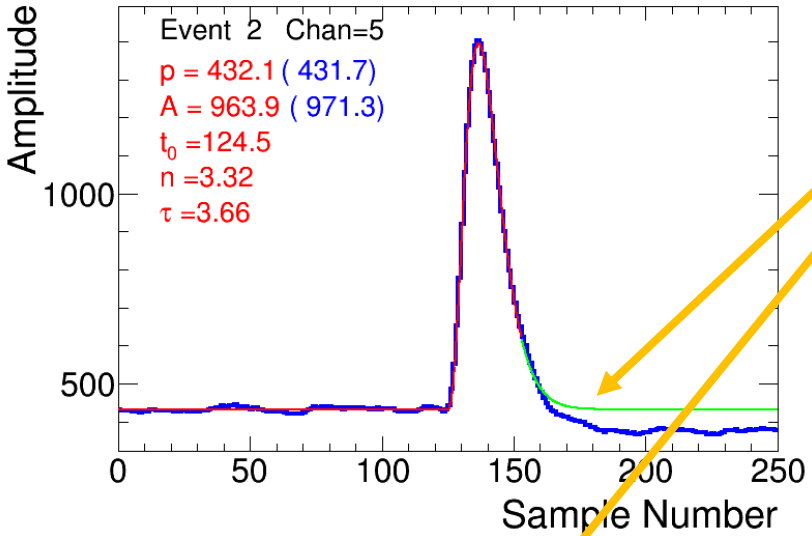
$$f(\xi, n) = e^{n(1+\log\xi-\xi)}$$

$$0 \le f(\xi, n) \le f(1, n) = 1$$

$$I = \int_{t_0}^{\infty} A(t)\,dt = A\tau n e^{n(1-\log n)}\Gamma(n)$$

$$\Gamma(n) = \int_0^{\infty} x^{n-1}e^{-x}dx$$

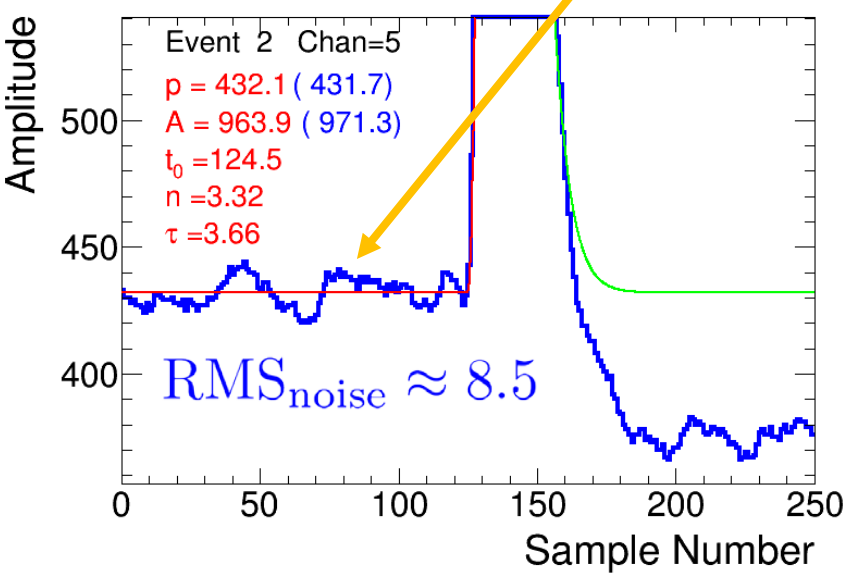
Quality of the Parametrization

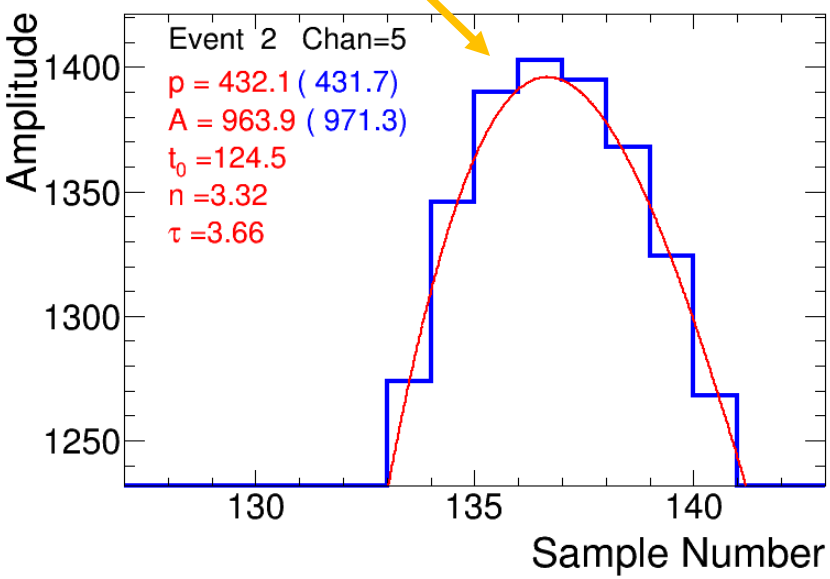


Some issues:

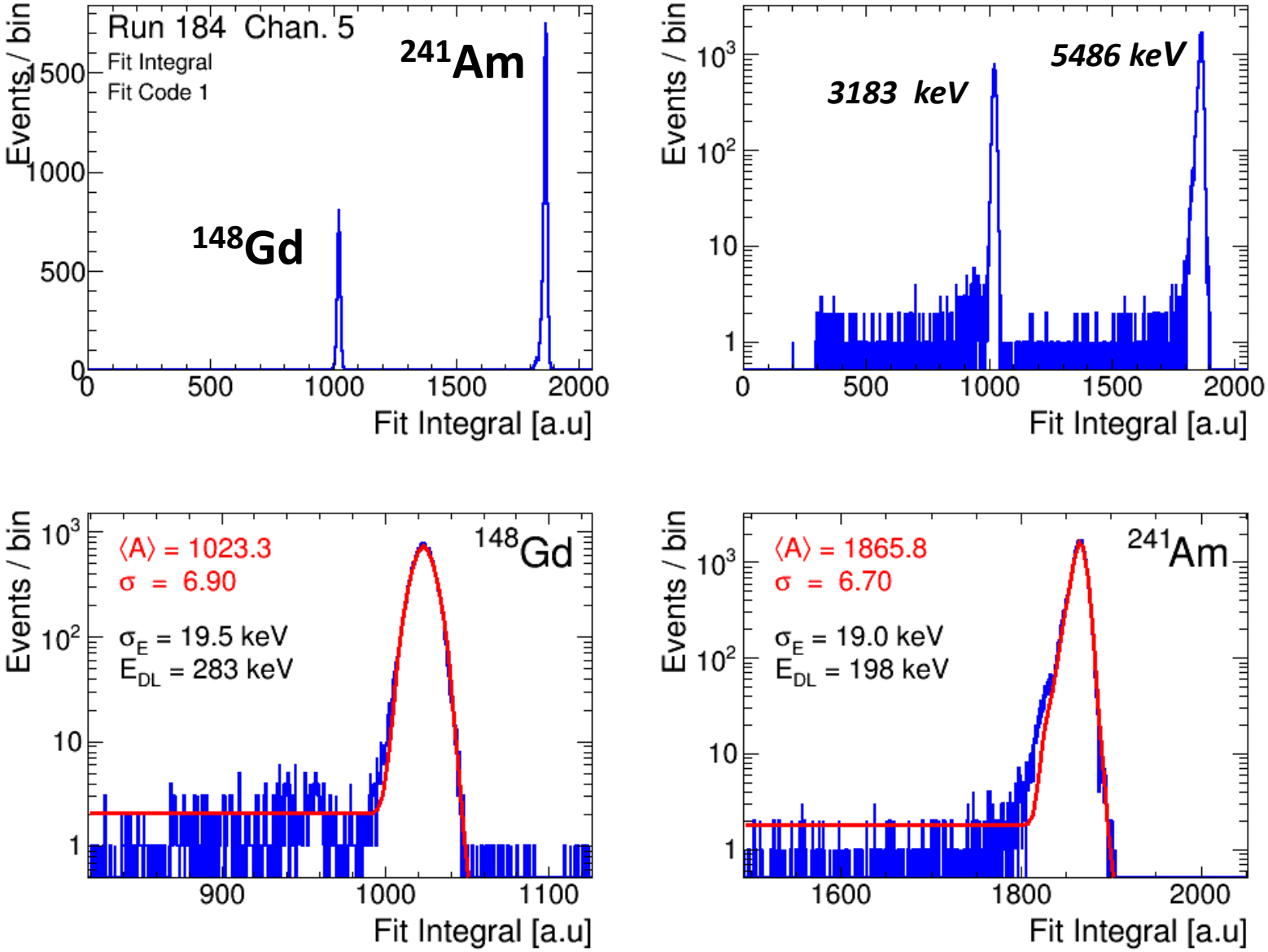
- ***Undershoot***
- ***Noise***
- ***Peak is not parameterized perfectly***

At moment parametrization is satisfactory



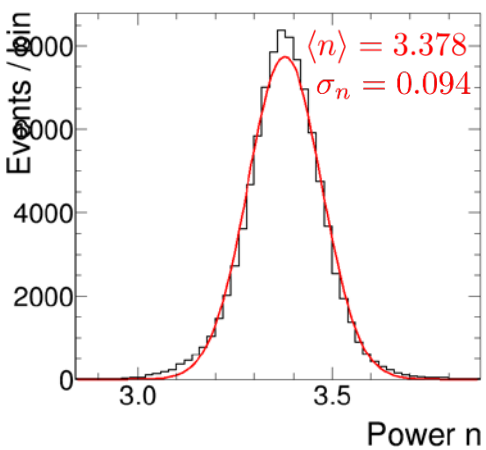


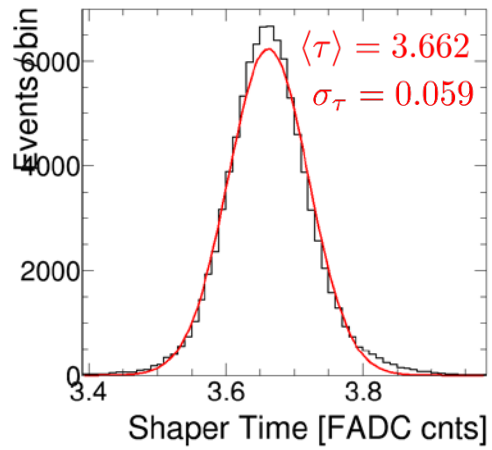
Alpha Run 184 (7 hours). Channel 5.

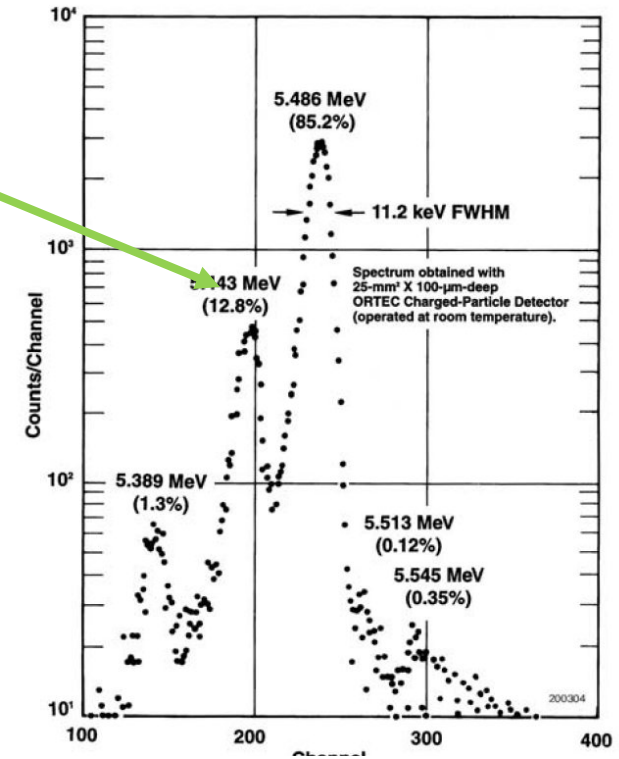


Comments to the Fit of the Spectra

- *Gd is approximated by Gaussian distr.*
- *Am is approximated by supeposition of 5 Gaussian distr. with same sigma*



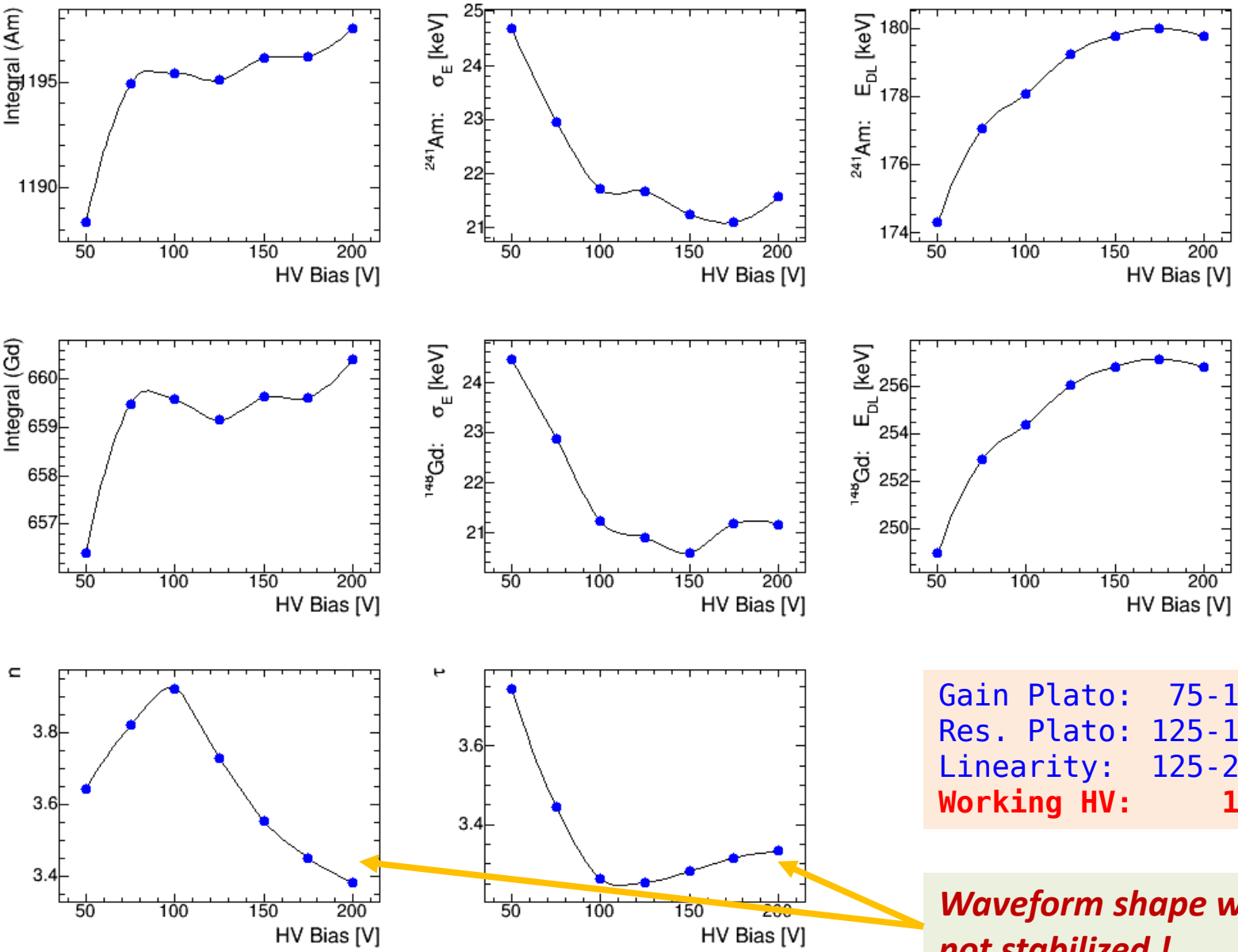




	Gadolinium			Americium		
	<A>	σ_E keV	E_{DL} keV	<A>	σ_E keV	E_{DL} keV
A_{max}	961.0	20.5	268	1746.7	20.4	187
A_{fit}	952.9	20.3	280	1736.4	20.1	196
Integral	**952.4**	**19.5**	**283**	**1736.7**	**19.0**	**198**
n=3.378 τ=3.662	952.6	**17.6**	282	1736.6	**16.7**	197

Energy losses for 1 MeV proton E_{DL} ~ 30 keV

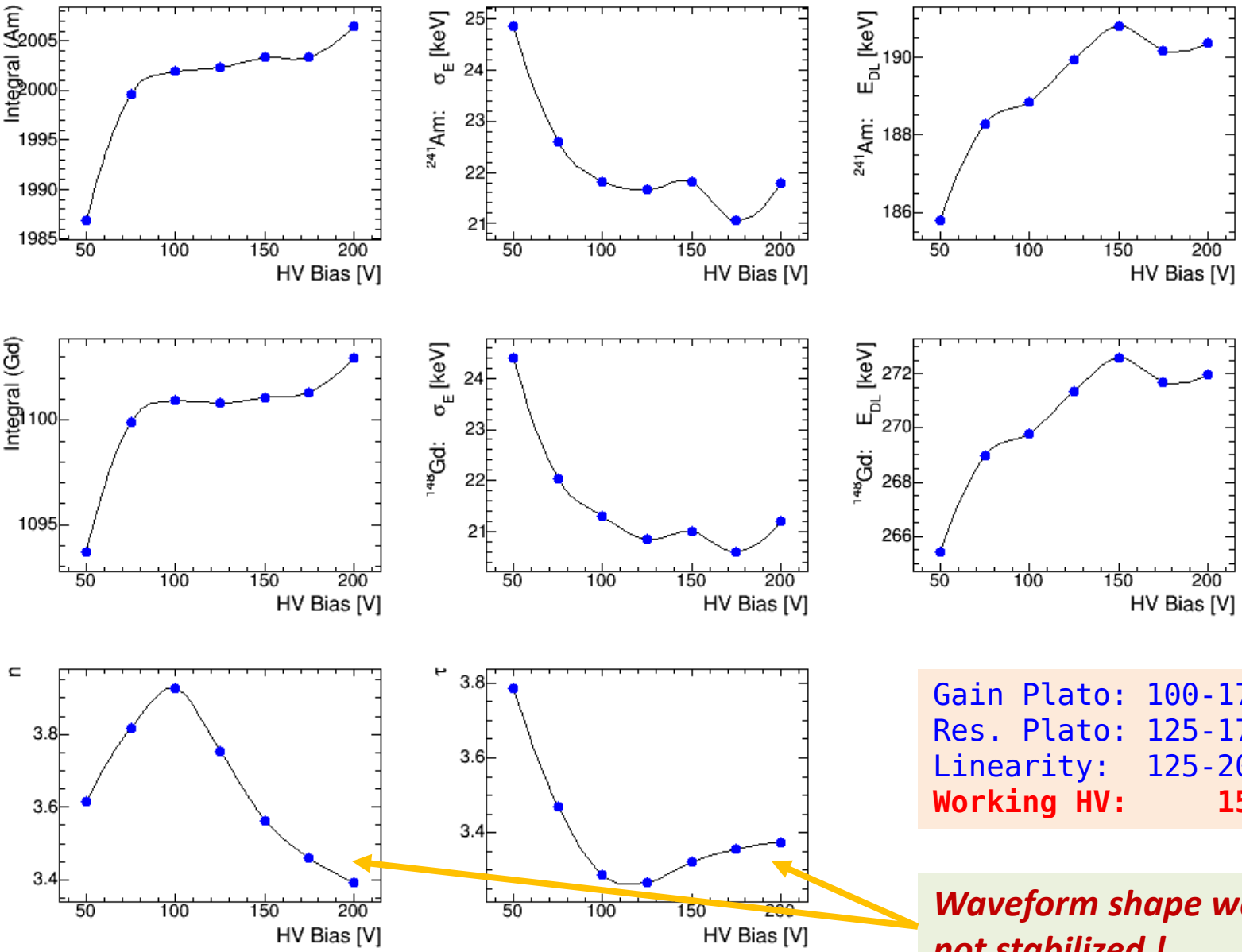
The dependence on HV. Chan 1. Bldg. 930



Gain Plato: 75-175 V
Res. Plato: 125-175 V
Linearity: 125-200 V
Working HV: 150 V

Waveform shape was not stabilized !

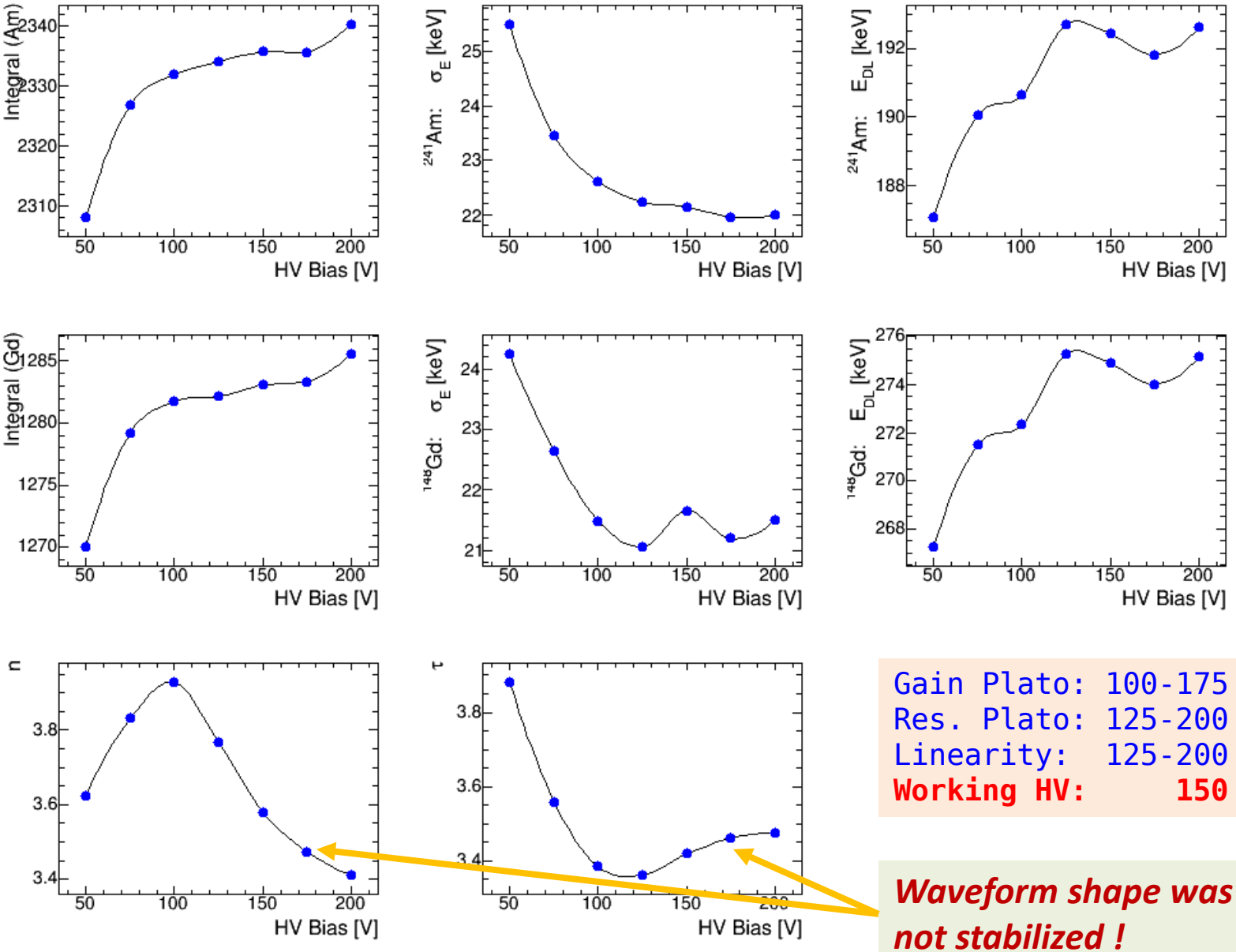
The dependence on HV. Chan 5. Bldg. 930



Gain Plato: 100-175 V
Res. Plato: 125-175 V
Linearity: 125-200 V
Working HV: 150 V

Waveform shape was not stabilized !

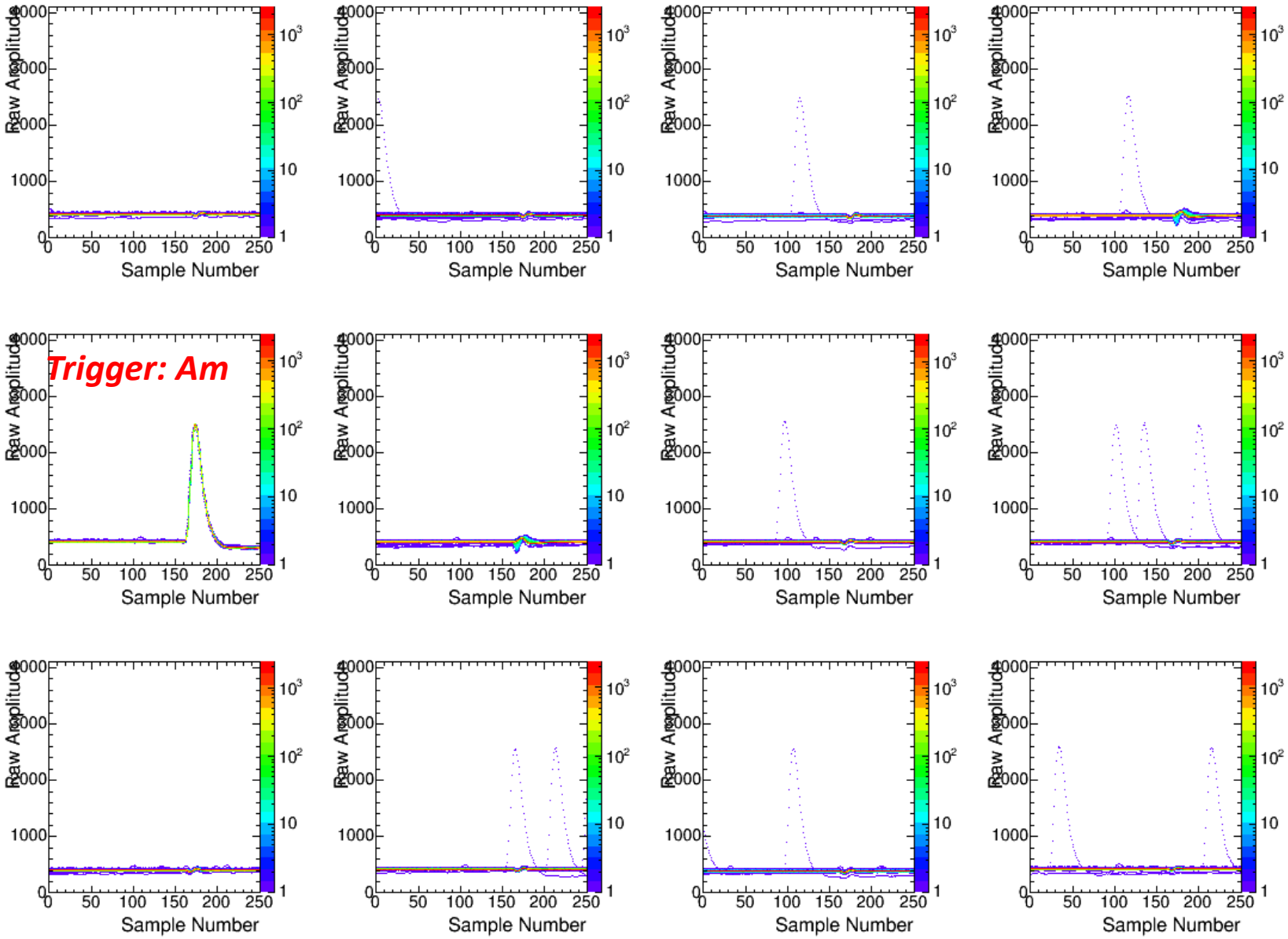
The dependence on HV. Chan 9. Bldg. 930



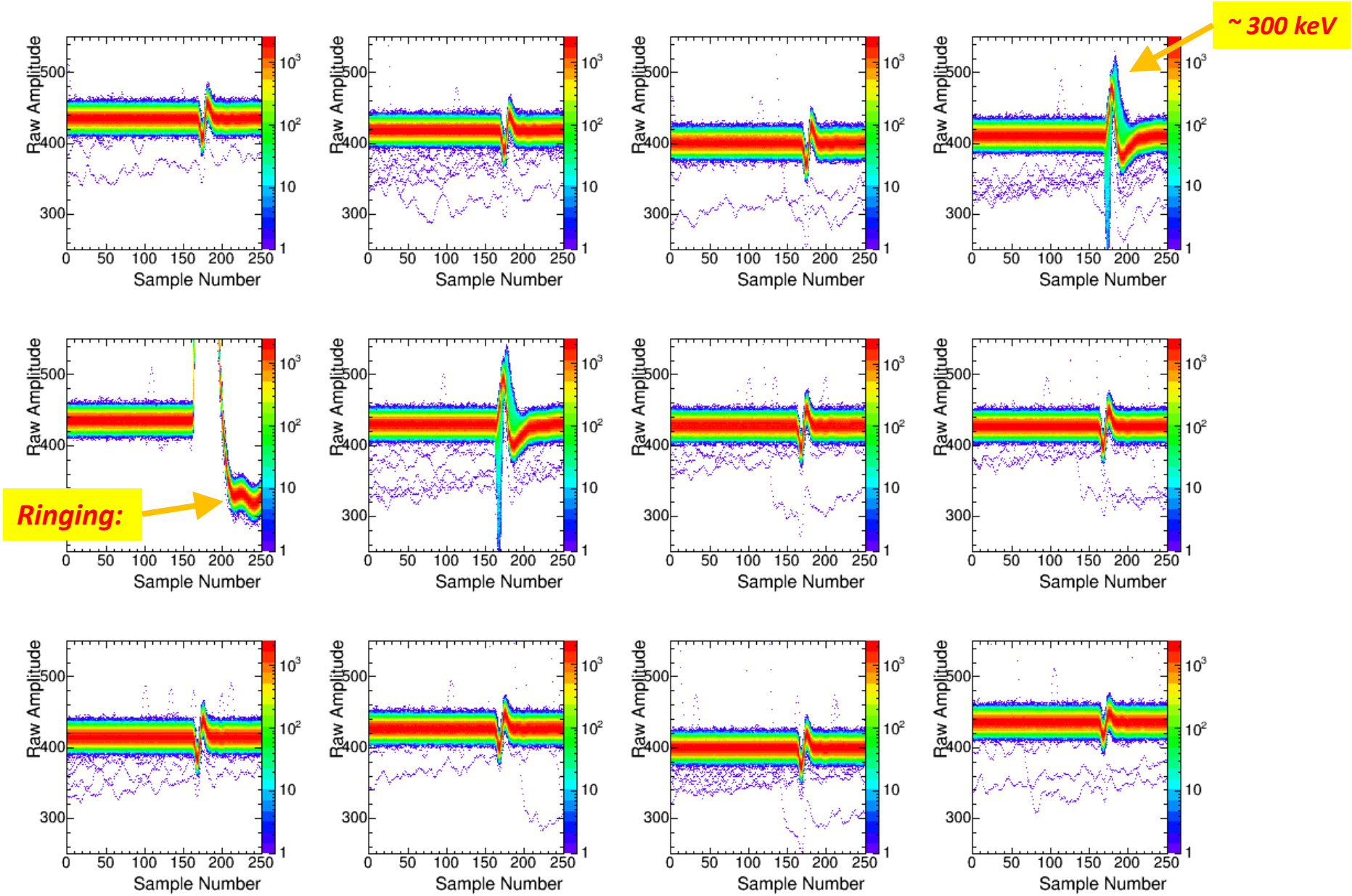
Gain Plato: 100-175 V
Res. Plato: 125-200 V
Linearity: 125-200 V
Working HV: 150 V

Waveform shape was not stabilized !

Cross Currents. Run 97 (Bldg. 930)

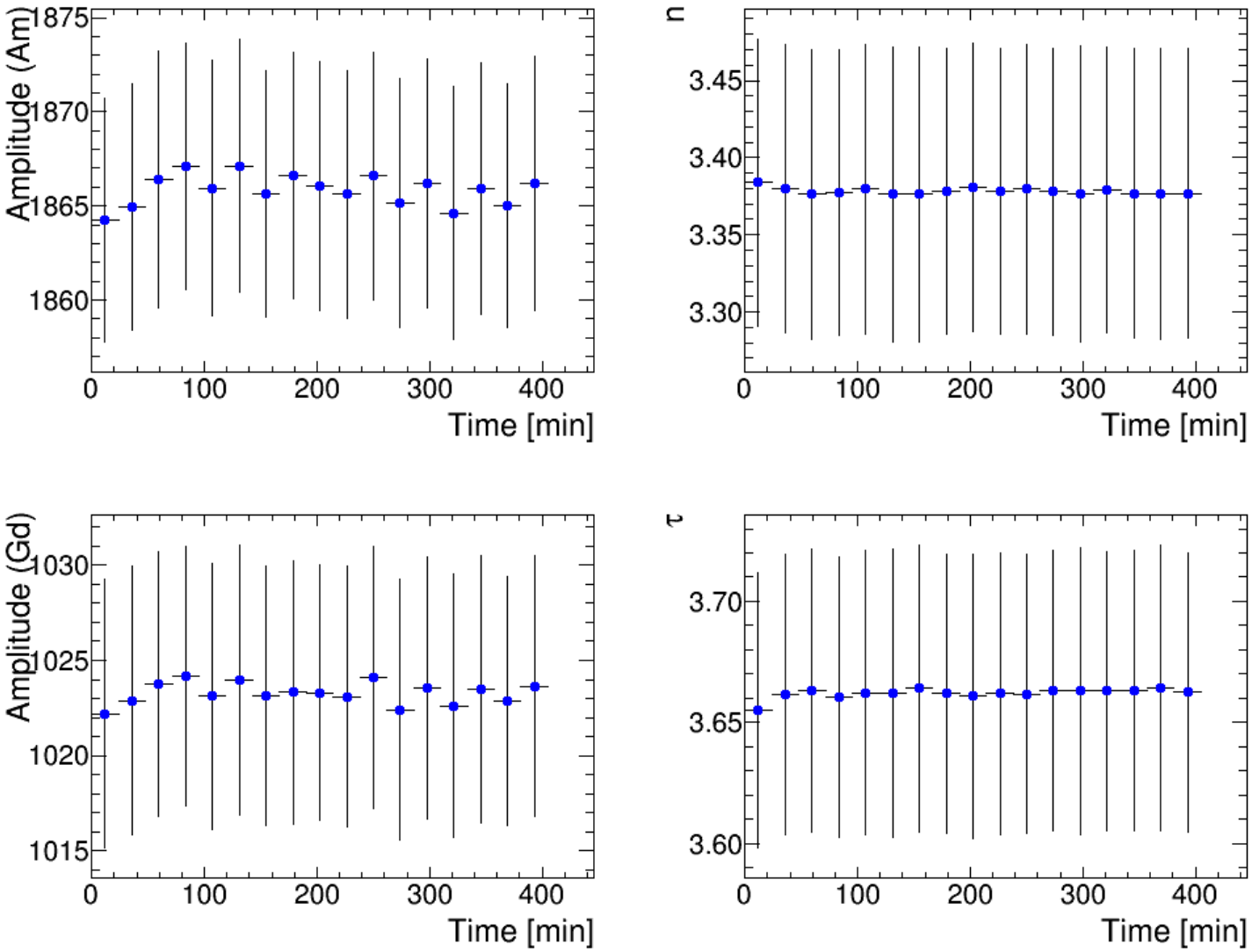


Cross Currents. Run 97 (Bldg. 930)



Long Term Stability. Run 184 (7 hours). Chan 5

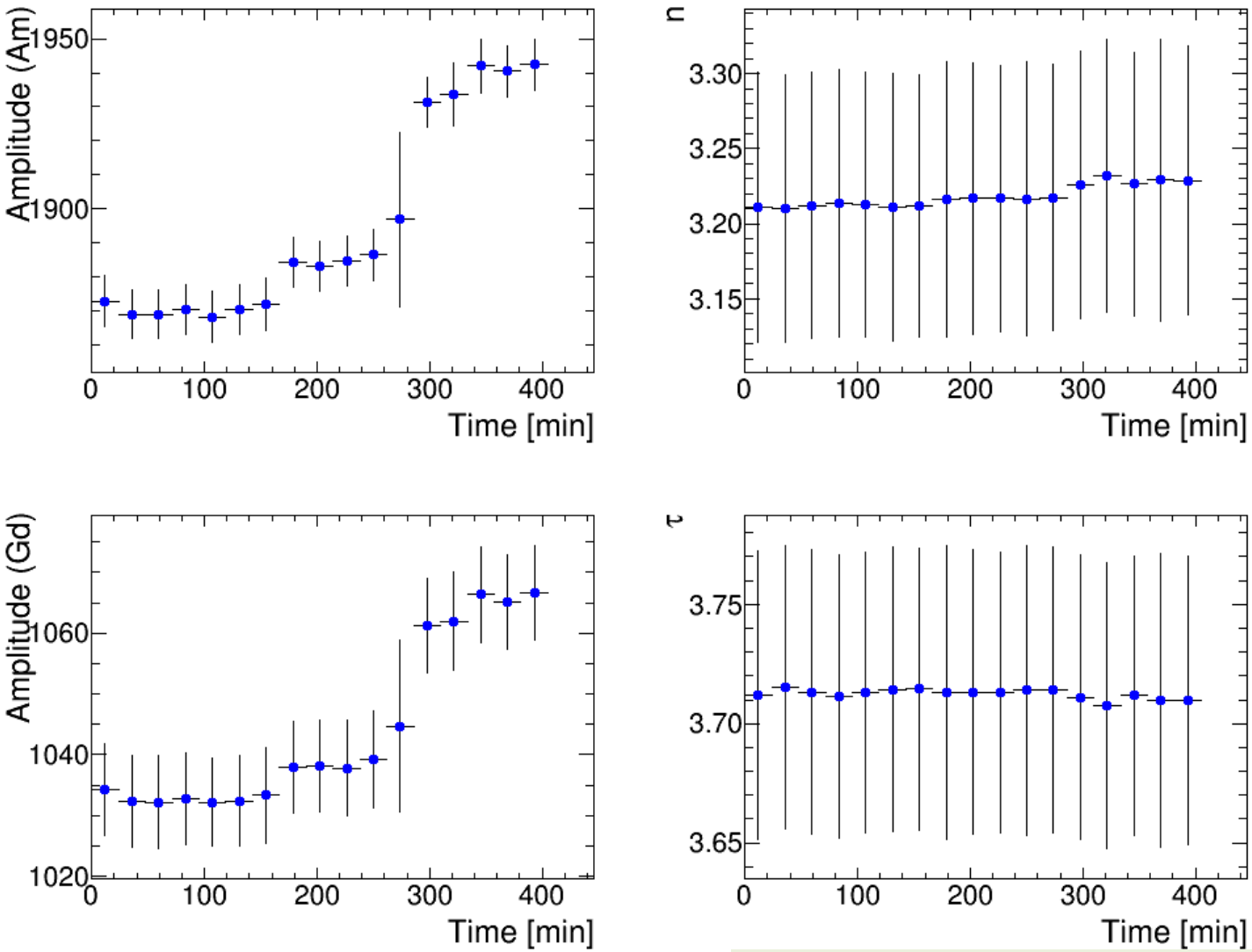
Best Channel



Error Bars show RMS of the distributions

Long Term Stability. Run 184 (7 hours). Chan 13

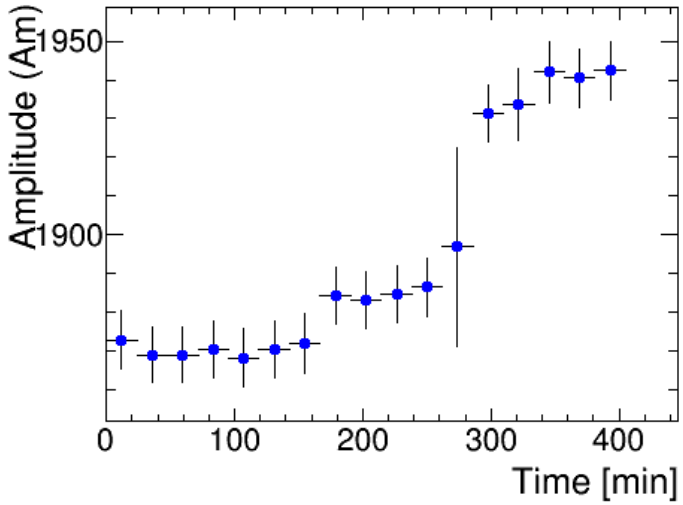
Worse Channel

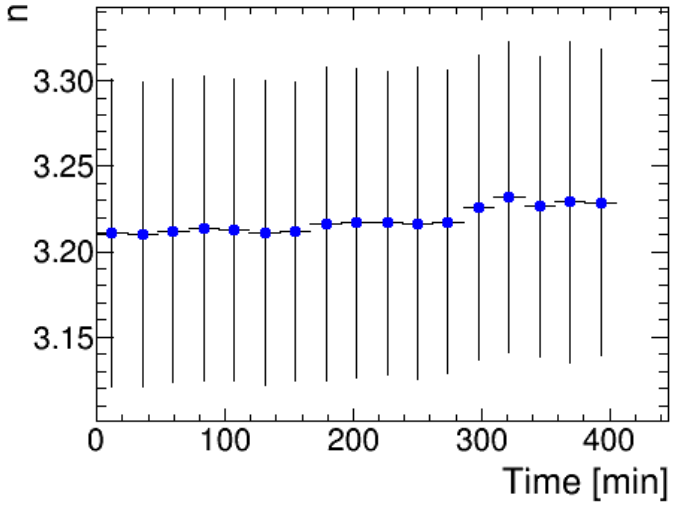


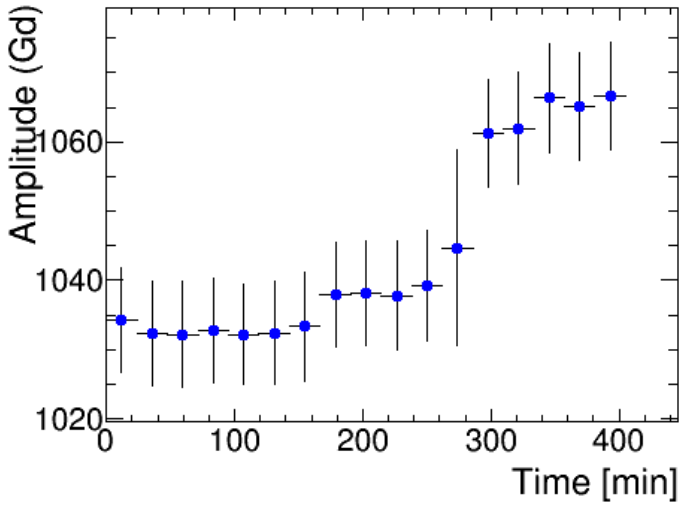
Error Bars show RMS of the distributions

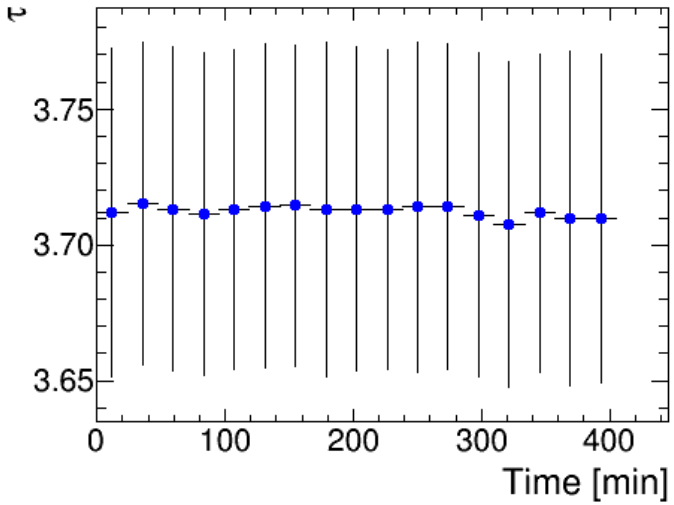
Long Term Stability. Run 184 (7 hours). Chan 45

Worse Channel





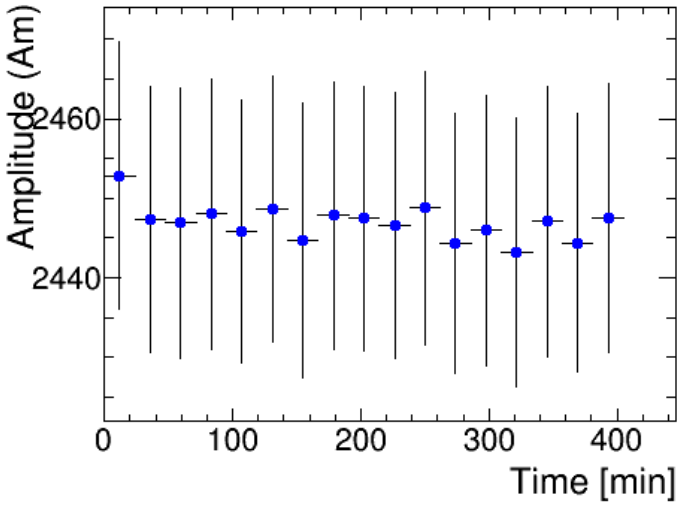


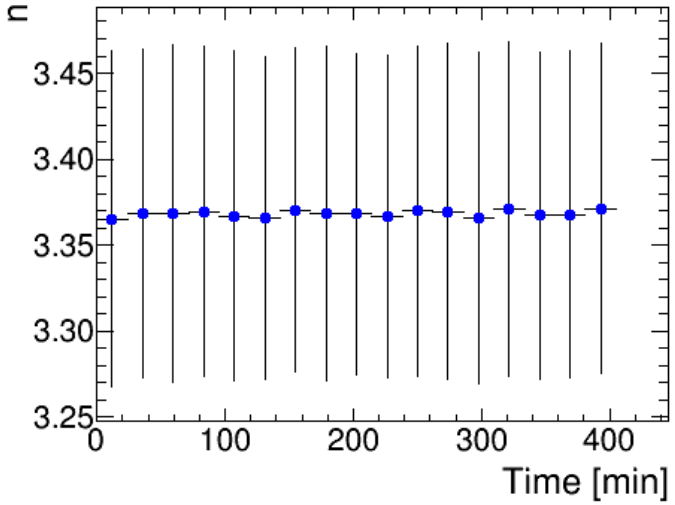


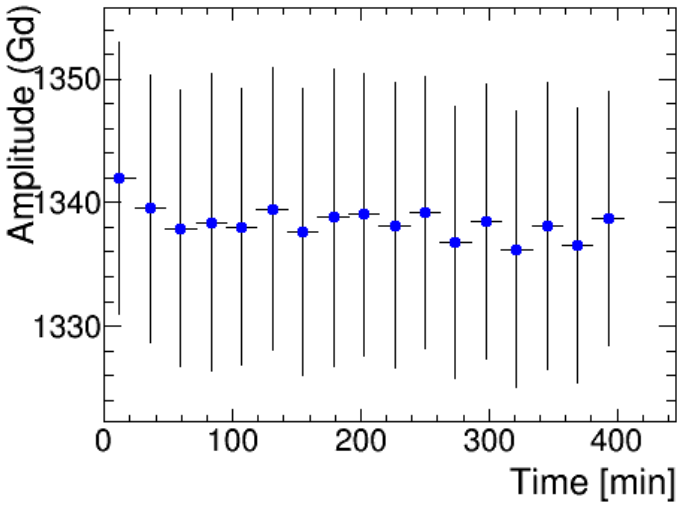
Error Bars show RMS of the distributions

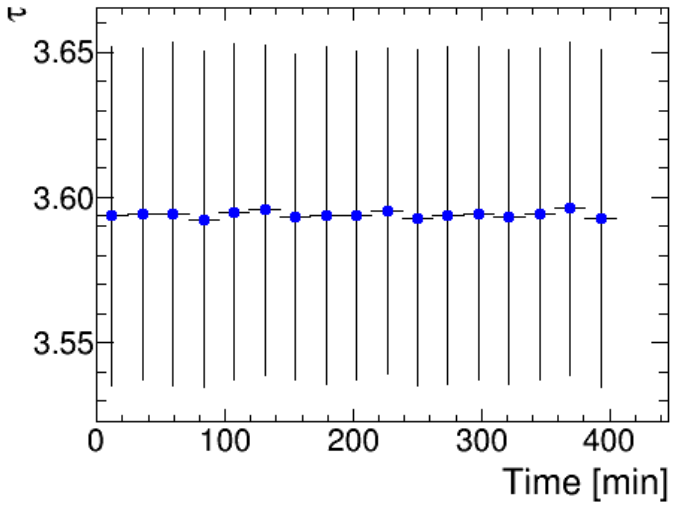
Long Term Stability. Run 184 (7 hours). Chan 85

Double Peak Channel







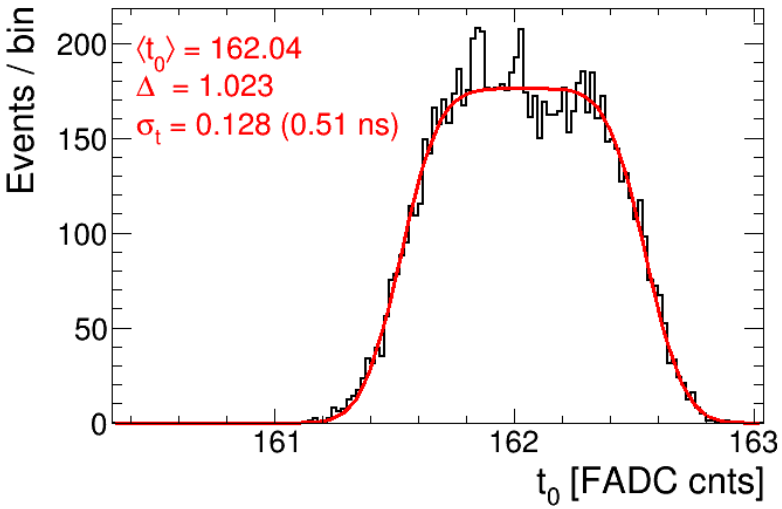


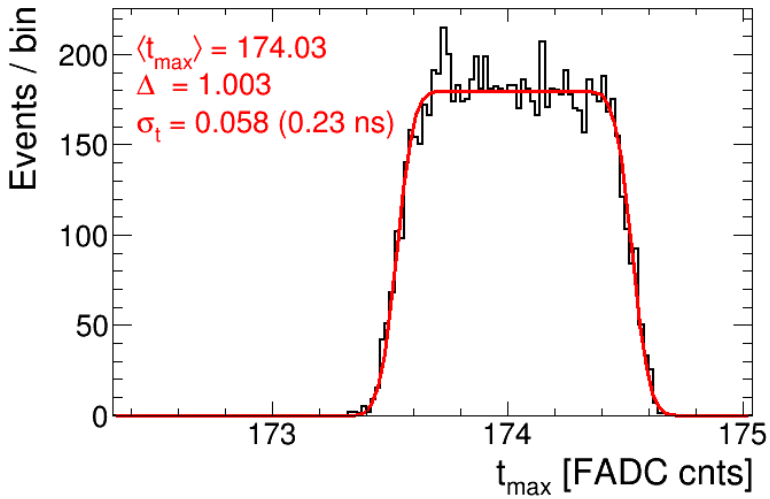
Error Bars show RMS of the distributions

Time Resolution.

$$t_m = t_0 + n\tau$$

Run 99 (Bldg.99)





t_m is better parametrization of of measured time.

Estimates: $\mathrm{Am\ 5.486\ MeV} : \sigma_t \leq 200\ \mathrm{ps}$

$\mathrm{Gd\ 3.183\ MeV} : \sigma_t \leq 300\ \mathrm{ps}$

$\mathrm{proton\ 1\ MeV} : \sigma_t \sim 1\ \mathrm{ns}$

Must be verified at RHIC !